

THE ASCOMYCETE GENUS GYMNOASCUS

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The ascomycete genus *Gymnoascus* is expanded, comprising all Gymnoascaceae with lenticular or discoid (not bivalvate), pigmented ascospores and with ascomata without long, circinate, arcuate, or comb-like appendages. Several species hitherto classified in separate genera are transferred to *Gymnoascus*. *Gymnoascus udagawae* spec. nov. is described. A key to the 14 accepted species is given. *Gymnoascus durus* Zukal is transferred to *Ascocalvatia*. A checklist of all fungi described in *Gymnoascus* is given.

Within the fungi classified in the Gymnoascaceae, von Arx (1971, 1974, 1977) distinguished three phylogenetic entities, which can be recognized easily by the shape and symmetry of the ascospores. The genera *Myxotrichum* Kunze, *Pseudogymnoascus* Raitlio, and *Byssosascus* v. Arx are characterized by ellipsoidal or fusiform ascospores having longitudinal furrows in *Byssosascus striatisporus* (Barron & Booth) v. Arx and being smooth or striate by crests in the species of the other genera (Müller & von Arx, 1982; Currah, 1985). The asci are usually spherical, with a distinct cylindrical stalk. Currah classified the three genera in a new family Myxotrichaceae; von Arx (1986) included them in the Onygenaceae, which were emended comprising all Eurotiales with ellipsoidal or fusiform ascospores.

The species of *Amauroascus* J. Schröt., *Arachnotheca* v. Arx, and *Auxarthron* Orr & Kuehn are characterized by spherical ascospores with an ornamented, reticulate, pitted, or striate, often thick wall. They may be related to *Emmonsia* Kwon-Chung, *Ajellomyces* McDonough & Levis, *Xylogone* v. Arx & Nilsson, and related genera, which have spherical, but apparently smooth and hyaline ascospores.

The Gymnoascaceae are now restricted to genera characterized by dorsiventrally flattened, bivalvate, lenticular, or discoid ascospores. Several genera are characterized by such ascospores, but von Arx (1974, 1977) accepted only a limited number including *Gymnoascus* Baranetzky (ascospores discoid, pigmented), *Arachniotus* J. Schröt. (ascospores lenticular, pigmented) and *Narasimhella* Thirumalachar & Mathur (ascospores bivalvate, hyaline). *Arachniotus ruber* (Tiegh.) J. Schröt. was selected as type species of *Arachniotus*, which was not accepted by Orr & al. (1977). They reintroduced the name *Gymnascella* for two species with discoid ascospores and 'naked' ascomata. Similar species with lenticular ascospores were classified in *Pseudoarachniotus* Kuehn. Currah (1985) restricted *Arachniotus* to *A. ruber* and transferred several other species to *Gymnascella*.

The present study began, when a specimen growing on a decaying hoof of a cow was collected. The specimen was identified as *Gymnoascus reticulatus* Zukal, which also

was collected on a hoof. Zukal (1887) described the fungus as follows (translated from German).

Ascomata roundish in outline, orange-reddish, about 500 μm in diameter, covered with a network of hyphae, which are about 5 μm broad, distinctly septate, and reddish; asci botryose, nearly spherical, about 13 μm ; ascospores lenticular, yellow, thick-walled, about 6.4 μm . No type specimen in existence.

On the present specimen, the ascomata are pulvinate, 200–400 μm and orange or pale reddish. They are covered by a network of rather thick-walled, 3–4 μm broad, near the septa 4.5–6 μm broad, smooth or verruculose hyphae. The spherical asci have a diameter of 12–16 μm and a thin but rather persistent wall. The ascospores are lenticular, roundish in face view, elliptical in lateral view, have an equatorial, band-like thickening and measure $6-7 \times 4-5 \mu\text{m}$. Young ascospores are yellow and become orange or ochraceous when mature.

Cultures on hay infusion agar show a poor growth and remain sterile. Ascomata with mature ascospores were observed only on sterilized pieces of hooves. The fungus apparently is highly keratinolytic. In other characters it represents a typical member of *Gymnoascus*. It differs from *G. reessii* mainly by larger ascospores with an equatorial band and by thicker peridial hyphae without seta-like branches.

The presence of an ascomatal peridium with or without seta-like branches in *Gymnoascus* and *Gymnascella* and its absence in *Arachniotus* is not adequate for the delimitation of genera. In some species a peridium is present when the ascomata develop on the natural substrate or in fresh isolates, but is absent in subcultures. *Arachniotus*, *Pseudoarachniotus*, *Petalosporus*, *Plunkettomyces*, *Disarticulatus*, and *Gymnascella* consequently are synonymized with *Gymnoascus*, which is emended as follows.

G Y M N O A S C U S Baranetzky

Gymnoascus Baranetzky in Bot. Ztg 30: 158. 1872. — Type: *G. reessii* Baranetzky.

Gymnascella Peck in Ann. Rep. N. Y. St. Mus. 35: 153. 1884. — Type: *Gymnascella aurantiaca* Peck.

Arachniotus J. Schröt. in Krypt.-Fl. Schlesiens 3(2): 210. 1893. — Type: *A. ruber* (Tiegh.) J. Schröt.

Pseudoarachniotus Kuehn in Mycologia 49: 694. 1957. — Type: *P. roseus* Kuehn.

Waldemaria Batista & al. in Atas Inst. Micol. Recife 1: 5. 1960. — Type: *W. pernambucensis* Batista & al. (= *G. dankaliensis*).

Petalosporus Ghosh & al. in Mycopath. Mycol. appl. 21: 36. 1963. — Type: *P. nodulosus* Ghosh & al.

Plunkettomyces Orr in Mycotaxon 6: 33. 1977. — Type: *P. littoralis* Orr.

Gymnoascoides Orr & al. in Mycotaxon 5: 459. 1977. — Type: *Gymnoascoides petalosporus* Orr & al.

Disarticulatus Orr in Mycotaxon 6: 35. 1977. — Type: *D. devroeyi* Orr.

Acitheca Currah in Mycotaxon 24: 63. 1985. — Type: *A. purpurea* Currah.

Colonies expanding, lemon yellow, ochraceous, orange, or red; ascomatal initials composed of a clavate or cylindrical ascogonium surrounded by a coiled antheridium, or of two coiled hyphal tips; ascomata embedded in the aerial mycelium, non stipitate,

Gymnoascus species are isolated from soil, dung, and plant debris, occasionally from hooves, nails, feathers, or hairs. On the natural substrate the ascomata are often covered with a network of hyphae, which may be absent or reduced in pure culture or when grown in moist chambers. Only a relatively small number of species includes anamorphs. These belong to the form genera *Malbranchea* and *Chrysosporium*, but are unnamed.

1 a.	Ascospores with an equatorial depression or furrow (Fig. 1a, e)	2
b.	Ascospores without equatorial furrow or depression	3
2 a.	Equatorial depression of the ascospores deep, distinct	<i>G. ruber</i>
b.	Equatorial depression of the ascospores shallow	<i>G. desertorum</i>
3 a.	Ascospores 3–4 μm in diameter, ascomata with a distinct peridium	4
b.	Ascospores 4–7 μm in diameter, ascomata with or without peridium	6
4 a.	Ascospores lenticular, with equatorial thickening	<i>G. alatosporus</i>
b.	Ascospores without equatorial thickening, usually discoid (Fig. 1h)	5
5 a.	Peridial hyphae stiff, with spine-like, often recurved branches	<i>G. reessii</i>
b.	Peridial hyphae thin, without spine-like branches	<i>G. petalosporus</i>
6 a.	Ascospores lenticular and with equatorial thickenings (Fig. 1b, c, d)	7
b.	Ascospores discoid or lenticular and without equatorial thickenings	10
7 a.	Colonies lemon-yellow, arthroconidia present, isolated from animals of marine environments	<i>G. littoralis</i>
b.	Colonies not lemon-yellow	8
8 a.	Keratinolytic, ascomata with a peridium of thick hyphae	<i>G. reticulatus</i>
b.	Not keratinolytic, ascomata without peridium of thick hyphae	9
9 a.	Ascospores 5.5–7 μm , with a distinct equatorial thickening and occasionally with polar thickenings	<i>G. dankaliensis</i>
b.	Ascospores 4.5–6 μm , with a broad equatorial band	<i>G. punctatus</i>
10 a.	Ascospores lenticular, with distinct poles; colonies lemon-yellow (Fig. 1f)	<i>G. citrinus</i>
b.	Above characters not combined	11
11 a.	Ascospores 6–7 \times 4–5 μm , thick-walled; colonies expanding, orange	<i>G. devroeyi</i>
b.	Ascospores smaller, usually discoid (Fig. 1g)	12
12 a.	Colonies orange or ochraceous, anamorphs absent	<i>G. aurantiacum</i>
b.	Colonies lemon-yellow or pale, anamorphs present	13
13 a.	Colonies restricted, conidia 2–3.5 μm broad	<i>G. nodulosus</i>
b.	Colonies expanding, conidia predominant, 6–15 \times 4–5 μm	<i>G. udagawae</i>

Most species are well described and correctly delimited by Currah (1985) as *Arachniotus*, *Gymnascella*, *Gymnoascoides*, and *Gymnoascum*. *Gymnascella* sensu Currah is polyphyletic; two species have to be retained in *Narasimhella* Thirumalachar & Mathur

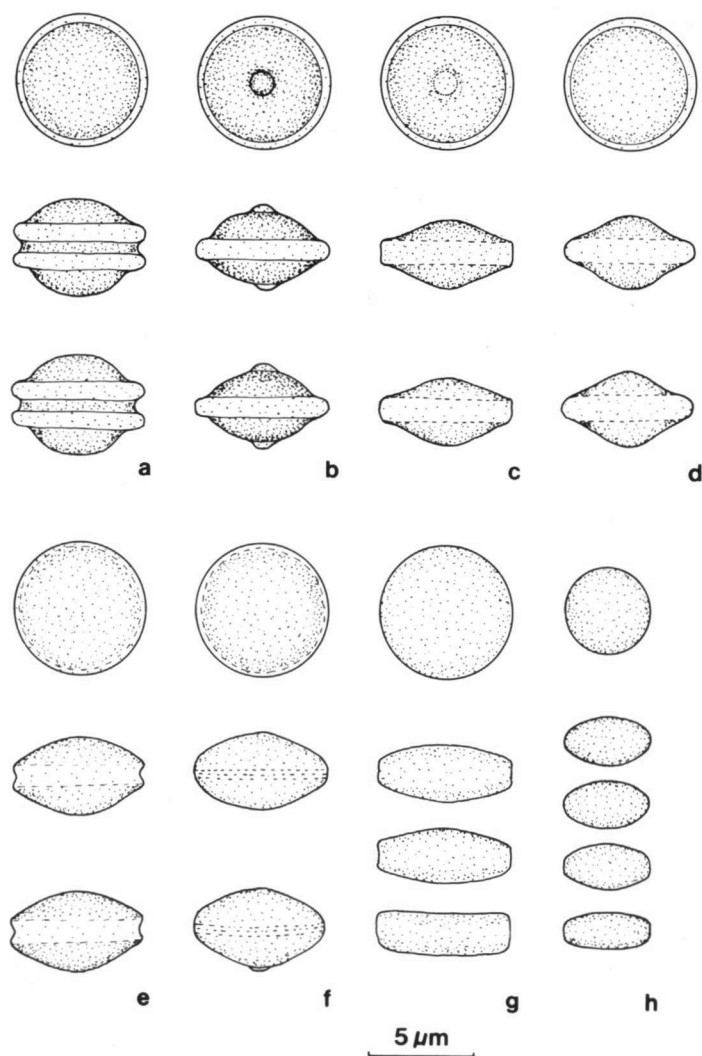


Fig. 1. Ascospores of *Gymnoascus* species in face and lateral view. — a. *G. ruber* (CBS 592.71). — b. *G. dankaliensis* (CBS 294.66). — c. *G. punctatus* (CBS 279.64). — d. *G. littoralis* (CBS 454.73). — e. *G. desertorum* (CBS 634.72). — f. *G. citrinus* (CBS 863.72). — g. *G. aurantiacus* (CBS 655.71) and *G. reessii* (CBS 111.12).

(type species: *N. poonensis* Thirumalachar & Mathur). This genus differs from *Gymnoascus* by unequally bivalvate, hyaline ascospores, obovate asci formed from croziers, and by often stipitate ascomata. *Narasimhella* is closely related to *Ctenomyces serratus* Eidam, *Leucosphaera emdenii* v. Arx & Samson and other species with similar, unequally bival-

vate, hyaline ascospores. The mycelial yeast *Saccharomycopsis capsularis* Schöningg also has bivalvate, smooth, hyaline ascospores and a relationship to the above mentioned Gymnoasceae has to be considered (von Arx & van der Walt, 1986).

CHECKLIST

List of species described as *Gymnoascus* (G.), *Arachniotus* (A.), *Gymnascella*, *Pseudarachniotus* (Ps.), and *Petalosporus* (P.).

Accepted names are printed *s p a c e d* or in bold-face type (if new).

P. a filamentosus Orr & Kuehn in Mycologia 64: 62. 1972. — *Gymnascella a filamentosa* (Orr & Kuehn) Currah = *G. n o d u l o s u s*.

G. a l a t o s p o r u s Natarajan in Proc. Indian Nat. Sci. Acad. 37: 124. 1971.

A. albicans Apinis in Mycol. Pap. 96: 45. 1967. — *Arachnotheca albicans* (Apinis) v. Arx in Gen. Fungi, 2nd ed., p. 98. 1974.

P. anodosus Kuehn & al. in Mycopath. Mycol. appl. 23: 30. 1964 = *G. n o d u l o s u s*.

G. a u r a n t i a c u s (Peck) Sacc., Syll. Fung. 8: 823. 1889 is based on *Gymnascella aurantiaca*, the type species of *Gymnascella* Peck.

Ps. aurantiacus Kamyschko in Niv. Sist. Niz. Rast. 4: 224. 1967. — *G. a u r a n t i a c u s* (Currah, 1985).

G. aureus Eidam in Jber. schles. Ges. Kultur 64: 161. 1887. — *Amauroascus aureus* (Eidam) v. Arx in Persoonia 6: 375. 1971.

G. bifurcatus (Orr) v. Arx in Gen. fungi, 3rd ed., p. 132. 1981. — *Macronodus bifurcatus* Orr in Mycotaxon 5: 283. 1977 = *Auxarthron conjugatum* (Kuehn) Orr & Kuehn (Currah, 1985).

G. bourquelotii Boudier in Bull. Soc. mycol. Fr. 8: 44. 1882 is a nomen dubium. No type specimen in existence.

G. brevisetosus Kuehn in Mycologia 48: 813. 1956 = *Auxarthron zuffianum* (Morini) Orr & Kuehn.

G. californiensis (Orr & Kuehn) Apinis in Mycol. Pap. 96: 12. 1964. — *Auxarthron californiense* Orr & Kuehn.

G. candidus Eidam in Jber. Schles. Ges. Kultur 6: 161. 1887 is a nomen dubium. No type specimen in existence.

G. citrinus (Masse & Salmon) v. Arx, *comb. nov.* — *Arachniotus citrinus* Masse & Salmon in Ann. Bot. 16: 62. 1902 (basionym).

G. confluens Sartory & Bainier in Bull. Soc. mycol. Fr. 29: 261. 1913 is a nomen dubium. No type specimen in existence. The neotype CBS 352.66 is identical to *G. aurantiacus* (Apinis, 1964).

G. corniculatus Orr & Plunkett in Mycopath. Mycol. appl. 21: 11. 1963 = *G. reesii* (Samsno, 1972).

G. dankaliensis (Castellani) v. Arx, *comb. nov.* — *Trichophyton dankaliense* Castellani in J. trop. Med. Hyg. 40: 315. 1937 (basionym). — *A. dankaliensis* (Castellani) v. Beyma in Antonie van Leeuwenhoek 8: 107. 1942.

G. demonbreunii Ajello & Cheng in Mycologia 59: 682. 1967. — *Neogymnomyces demonbreunii* (Ajello & Cheng) Orr (Currah, 1985). Subcultures of the type are sterile.

G. desertorum (Moustafa) v. Arx, *comb. nov.* — *A. desertorum* Moustafa in Trans. Br. mycol. Soc. 61: 392. 1973 (basionym).

G. devroeyi (Orr) v. Arx, *comb. nov.* — *Disarticulatus devroeyi* Orr in Mycotaxon 6: 35. 1977 (basionym).

G. dugwayensis Orr & Kuehn in Mycologia 64: 65. 1972 = *G. reessii* (Currah, 1985). A subculture of the type proved to be sterile.

G. durus Zukal in Ber. dt. bot. Ges. 8: 295. 1890 (basionym). — *Keratinophyton durum* (Zukal) Currah in Mycotaxon 24: 156. 1985. — *Ascocalvatia dura* (Zukal) v. Arx, *comb. nov.* No type specimen in existence.

Zukal (1890) described the fungus as follows (translated from German): Ascomata spherical, 1–1.5 mm in diameter, white or pale brownish, aggregated in a stroma, hard, with an about 140 μ m thick covering composed of thick-walled filaments; asci in irregular balls, spherical, 8-spored, 6–7 \times 5–6 μ m, surrounded by branched, tapering filaments; ascospores cylindrical or ellipsoidal, with truncate ends, pale yellow when mature, 3–4.5 \times 2.5 μ m.

This description agrees with that of *Ascocalvatia alveolata* Malloch & Cain (1971). Both species are congeneric, probably conspecific. The genus is a typical Onygenaceae (Malloch & Cain, 1971). The fungus is rare. I observed it about 20 years ago on a cadaver of a salamander. Cultures on agar media from germinating ascospores remained sterile.

The fungus which Currah (1985) identified with *Gymnoascus durus* differs in spherical ascomata with a dark wall composed of angular cells and in discoid ascospores with a thickened and distinctly pitted margin. It represents a probably undescribed species of *Anixiopsis* = *Aphanoascus*.

Ps. echinulatus Dutta & Ghosh in Mycologia 55: 775. 1963. — *Amauroascus echinulatus* (Dutta & Ghosh) v. Arx — *Narasimhella echinulata* (Dutta & Ghosh) v. Arx — *Mallochia echinulata* (Dutta & Ghosh) v. Arx & Samson. This species has to be classified in the Eurotiaceae, because the lenticular, bivalvate ascospores have an equatorial furrow and are echinulate.

G. eidamii Cocconi in Mem. Accad. Sci. Bologna 5: 32. 1891 = *Auxarthron zuffianum* (Currah, 1985).

A. flavoluteus Kuehn & Orr in Mycologia 51: 864. 1959 = *G. dankaliensis* (Currah, 1985). Subcultures of the type differ slightly from typical strains of *G. dankaliensis* by paler colonies and the presence of arthroconidia.

G. flavus Klöcker in Hedwigia 41: 80. 1902. — *Talaromyces flavus* (Klöcker) Stolk & Samson in Stud. Mycol. 2: 10. 1972 (Onygenaceae).

A. glomeratus Müller & Pacha-Aue in Nova Hedwigia 15: 544. 1968. — *Arachnotheca glomerata* (Müller & Pacha-Aue) v. Arx in Persoonia 6: 376. 1971.

G. gypseus Nannizzii in Atti Accad. Fisiocr. Sienna 2: 94. 1927. — *Nannizzia gypsea* (Nannizzii) Stockdale in Sabouraudia 1: 45. 1961.

Ps. halophilus Pawar & al. in Mycopath. Mycol. appl. 40: 100. 1970 = *G. dankaliensis* (von Arx, 1971).

A. hebridensis Apinis in Mycol. Pap. 96: 41. 1964. This is a *Chrysosporium* species (von Arx, 1971).

Ps. hyalinusporus Kuehn & al. in Mycopath. Mycol. appl. 14: 215. 1961. — *Narasimhella hyalinosporea* (Kuehn & al.) v. Arx in Persoonia 6: 374. 1971.

A. indicus Chattop. & Das Gupta in Trans. Br. mycol. Soc. 42: 72. 1959 = *Talaromyces flavus* (Stolk & Samson, 1972).

A. intermedius Apinis in Mycol. Pap. 96: 45. 1964. — *Talaromyces intermedius* (Apinis) Stolk & Samson in Stud. Mycol. 2: 21. 1972.

G. intermedius Orr in Mycotaxon 5: 470. 1977 = *G. reessii* (von Arx, 1981). Currah (1985) accepted this species.

G. johnstonii (Masse & Salmon) Orr & Kuehn in Mycopath. Mycol. appl. 21: 8. 1963 is a nomen dubium. No type specimen in existence.

Gymnascella kamyschkoi Orr & al. in Mycologia 69: 137. 1977 = *G. aurantiacus* (Currah, 1985).

A. lanatus Apinis in Mycol. Pap. 96: 39. 1964 is a nomen dubium. No type specimen in existence.

A. lectardii Nicot in Bull. Soc. mycol. Fr. 85: 319. 1969. — *Eleutherascus lectardii* (Nicot) v. Arx in Persoonia 6: 378. 1971.

G. littoralis (Orr) v. Arx, *comb. nov.* — *Plunkettomyces littoralis* Orr in Mycotaxon 6: 33. 1977 (basionym).

G. longitrichus Orr & Kuehn in Mycopath. Mycol. appl. 21: 9. 1963 = *G. reessii* (Currah, 1985).

G. luteus Sacc., Syll. Fung. 11: 437. 1894. — *Talaromyces luteus* (Sacc.) Stolk & Samson in Stud. Mycol. 2: 23. 1972.

Ps. marginosporus Kuehn & Orr in Mycopath. Mycol. appl. 19: 257. 1963 (basionym). — *Narasimhella marginospora* (Kuehn & Orr) v. Arx, *comb. nov.*

Narasimhella marginospora is closely related to *N. poonensis* Thirumalachar & Mathur (1966), but differs by the less distinct equatorial rim of the ascospores and by the absence of stipitate ascomata. *Narasimhella hyalinasporea*, the third species, has ascospores without a distinct rim. In all species the outer (upper) volva of the ascospores has a thicker wall than the inner (lower) volva, which may be covered with some granulae. A strain isolated in 1978 from dung received from India (CBS 125.78) forms distinct, stipitate, orange ascomata and oblate ascospores without rim or brim (Fig. 2).

G. myriosporus Rostr. in Meddr. Groenland 18: 12. 1894 is a doubtful species. No type specimen in existence. Probably a *Thelebolus* has been described.

A. niger (J. Schröt.) Kuehn & al. in Mycopath. Mycol. appl. 25: 106. 1965. — *Amarosascus niger* J. Schröt.

G. nodulosus (Ghosh & al.) v. Arx, *comb. nov.* — *P. nodulosus* Ghosh & al. in Mycopath. Mycol. appl. 21: 36. 1963 (basionym).

G. ossicola Rostr. in Bot. Tidskr. 21: 45. 1897. — *Nannizzia ossicola* (Rostr.) Apinis, but is a doubtful species. No type specimen in existence.

G. petalosporus (Orr & al.) v. Arx in Persoonia 9: 397. 1977 is based on *Gymnoascoides petalosporus* Orr & al. in Mycotaxon 5: 459. 1977.

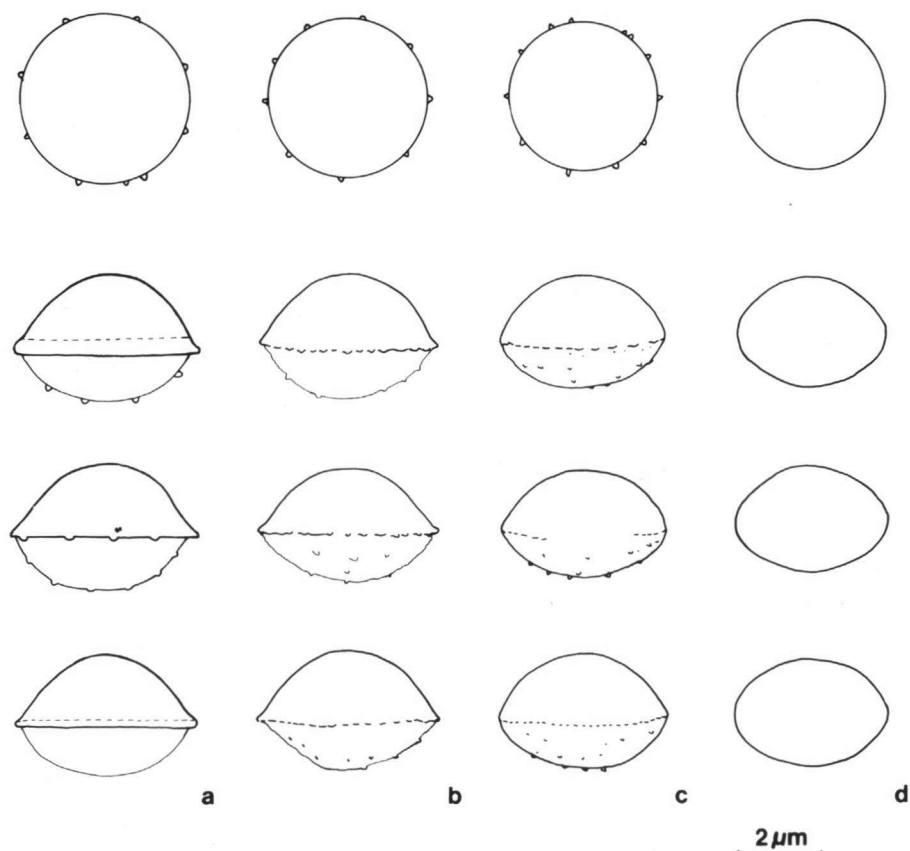


Fig. 2. Ascospores of *Narasimhella* species in face and lateral view. — a. *N. poonensis* (CBS 393.71). — b. *N. marginospora* (CBS 115.54). — c. *N. hyalinospora* (CBS 548.72). — d. *Narasimhella* spec. (CBS 125.78).

G. punctatus (Dutta & Ghosh) v. Arx, *comb. nov.* — *Ps. punctatus* Dutta & Ghosh in *Mycologia* 56: 153. 1964 (basionym).

A. purpureus Müller & Pacha-Aue in *Nova Hedwigia* 15: 552. 1968. — *Talaromyces purpureus* (Müller & Pacha-Aue) Stolk & Samson in *Stud. Mycol.* 2: 57. 1972.

G. reessii Baranetzky in *Bot. Ztg* 30: 158. 1872.

G. reticulatus Zukal in *Verh. zool.-bot. Ges. Wien* 37: 40. 1887.

Ps. reticulatus Kuehn & Goos in *Mycologia* 52: 40. 1960. — *Amauroascus reticulatus* (Kuehn & Goos) v. Arx in *Persoonia* 6: 375. 1971 (but see Currah, 1985).

A. reticulatus Kuehn in *Mycologia* 49: 57. 1957 = *Amauroascus kuehneii* v. Arx in *Persoonia* 6: 376. 1971.

G. rhouxiogongylinus Wener & Cain in Can. J. Bot. 48: 325. 1970 = *Pseudogymnoascus roseus* Raillo (Samson, 1972).

G. roseus (Raillo) Apinis in Mycol. Pap. 96: 8. 1964. — *Pseudogymnoascus roseus* Raillo. Currah (1985) synonymized *Pseudogymnoascus bhattii* Samson with *Ps. roseus*, but it differs by the absence of a *Geomyces* (*Chrysosporium*) anamorph and by the colour of the colonies.

Ps. roseus Kuehn in Mycologia 49: 695. 1957 = *G. dankaliensis* (Castellani) v. Arx (von Arx, 1971).

G. ruber Tiegh. in Bull. Soc. bot. Fr. 24: 159. 1877 is also known as *A. ruber*.

G. setosus Eidam in Bot. Zentbl. 10: 107. 1882. — *Myxotrichum setosum* (Eidam) Orr & Plunkett in Can. J. Bot. 41: 1470. 1963.

G. siglerae v. Arx in Gen. Fungi, 3rd ed., p. 132. 1981 = *Uncinocarpus reessii* Sigler & Orr in Mycotaxon 4: 461. 1976. The ascospores are similar to those of *G. reessii*: 4–5 μ m in diameter, discoid or slightly lenticular, pale brown when mature. *Uncinocarpus* can be accepted as a separate genus of the Gymnoascaceae, when *G. uncinatus* is included in it. Both species form superficial ascomatal structures with long, thick-walled, apically circinate setae and include *Malbranchea* anamorphs (Currah, 1985). In pure culture only the anamorphs develop; asci are formed in moist chambers on hairs mixed with soil.

G. stipitatus Lindfors in Svensk bot. Tidskr. 14: 270. 1920. — *Myxotrichum stipitatum* (Lindfors) Orr & Kuehn in Can. J. Bot. 41: 1471. 1963.

A. striatisporus Barron & Booth in Can. J. Bot. 44: 1060. 1966. — *Byssosascus striatisporus* (Barron & Booth) v. Arx in Persoonia 6: 377. 1971.

G. subumbrinus A. L. Smith in Trans. Br. mycol. Soc. 5: 424. 1917 = *Auxarthron umbrinum* (Boud.) Orr & Plunkett in Can. J. Bot. 41: 1446. 1963.

G. sudans Valionis in Vyt. Didziojo Mat. Gamtos Fak. Darbei 11: 115. 1936 = *Byssosochlamys nivea* Westling (Stolk & Samson, 1971).

Ps. terrestris Thirumalachar & Mathur in Mycopath. Mycol. appl. 40: 102. 1970 = *G. dankaliensis* (von Arx, 1971).

Ps. thirumalacharii Mathur in Mycopath. Mycol. appl. 40: 101. 1970 = *G. dankaliensis* (von Arx, 1971).

A. trachyspermus Shear in Science 16: 138. 1902. — *Talaromyces trachyspermus* (Shear) Stolk & Samson in Stud. Mycol. 2: 32. 1972. *T. spiculisporus* (Lehman) C. R. Benjamin is a synonym.

A. trisporus Hotson in Mycologia 28: 500. 1936 = *Byssosochlamys nivea* Westling (Stolk & Samson, 1971).

Ps. trochleosporus Kuehn & Orr in Mycologia 64: 58. 1972 = *G. ruber* Tiegh. (Currah, 1985).

Gymnoascus udagawae v. Arx, spec. nov. — Fig. 3

Coloniae expandae, citrino-luteae; mycelium ex hyphis septatis hyalinis, 1.5–4 μ m in diam. compositum; asci aggregati, sessiles, globosi vel subglobosi, tenui-tunicati, 8-spори, 8–11 μ m in diam.; ascospores dorsiventrali compressae, discoideae, flavae, 4–5 \times 2.5–

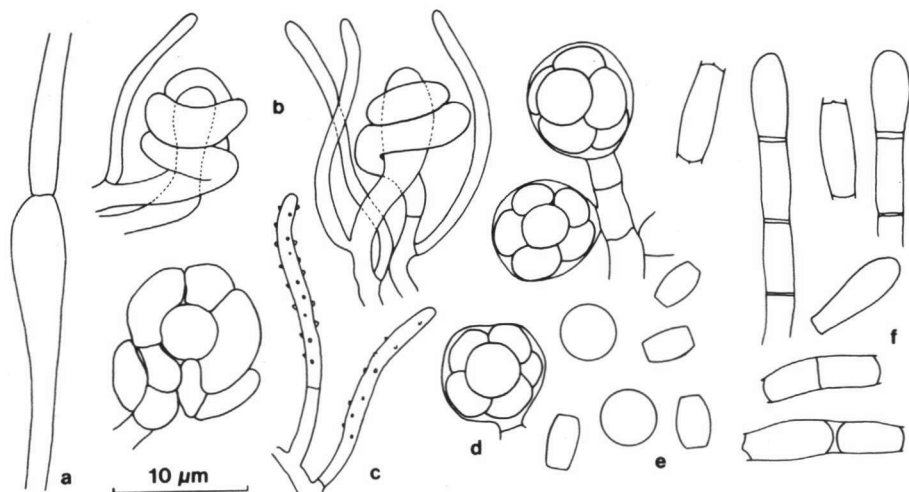


Fig. 3. *Gymnoascus udagawae* (CBS 950.69). — a. Swollen hypha. — b. Initials. — c. Verrucose hyphae surrounding the ascumata. — d. Asci. — e. Ascospores in face and lateral view. — f. Conidia.

3.5 μm ; arthro- e aleurioconidia numerosa, cylindracea vel clavata, hyalina, 0- vel 1-septata, 6–15 \times 3–5 μm .

Typus exsiccatus CBS (CBS 950.69, IFO 8921, ATCC 24072).

This species is known by a soil isolate from Japan, described and depicted by Udagawa and Takada (1968) as *A. hebridensis* Apinis. It differs from other species with lemon yellow colonies by the daily growth rate of the aerial mycelium (3–4 mm at 25°C on hay infusion agar), the relatively small, lenticular ascospores without equatorial thickenings and the abundant formation of relatively large conidia. Young ascumata are surrounded by delicate, hyaline, often verrucose hyphae extending the asci (Fig. 3).

G. umbrinus Boudier in Bull. Soc. mycol. Fr. 8: 43. 1892. — *Auxarthron umbrinum* (Boud.) Orr & Plunkett in Can. J. Bot. 41: 1446. 1963.

G. uncinatus Eidam in Beitr. Biol. Pfl. 3: 292. 1880. — *Uncinocarpus uncinatus* (Eidam) Currah in Mycotaxon 24: 186. 1985.

G. verrucosus Eidam in Jber. schles. Ges. 64: 162. 1887 = *Amauroascus mutatus* (Quél.) Rammeloo in Bull. Jard. bot. nat. Belg. 52: 241. 1982.

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